

Unit: Option 2

IB Expectations/ Assessment Criteria

DP Group 4: Chemistry, DP - Age 16-18, Syllabus - Option C

Option C: Chemistry in industry and technology (15/22 hours)

C1 Iron, steel and aluminium

- C.1.1 State the main sources of iron.
- C.1.2 Describe and explain the reactions that occur in the blast furnace.
- C.1.3 Describe and explain the conversion of iron into steel using the basic oxygen converter.
- C.1.4 Describe alloys as a homogeneous mixture of metals or a mixture of a metal and non-metal.
- C.1.5 Explain how alloying can modify the properties of metals.
- C.1.6 Describe the effects of heat treatment of steel.
- C.1.7 Describe the properties and uses of iron and steel.
- C.1.8 Describe and explain the production of aluminium by electrolysis of alumina in molten cryolite.
- C.1.9 Describe the main properties and uses of aluminium and its alloys.
- C.1.10 Discuss the environmental impact of iron and aluminium production.

C2 The oil industry

- C.2.1 Compare the use of oil as an energy source and as a chemical feedstock
- C.2.2 Compare catalytic cracking, thermal cracking and steam cracking.

C3 Addition polymers

- C.3.1 Describe and explain how the properties of polymers depend on their structural features.
- C.3.2 Describe the ways of modifying the properties of addition polymers.
- C.3.3 Discuss the advantages and disadvantages of polymer use.

C4 Catalysts

- C.4.1 Compare the modes of action of homogeneous and heterogeneous catalysts.
- C.4.2 Outline the advantages and disadvantages of homogeneous and heterogeneous catalysts.

- C.4.3 Discuss the factors in choosing a catalyst for a process.

C5 Fuel cells and rechargeable batteries

- C.5.1 Describe how a hydrogen–oxygen fuel cell works.
- C.5.2 Describe the workings of rechargeable batteries.
- C.5.3 Discuss the similarities and differences between fuel cells and rechargeable batteries.

C6 Liquid crystals

- C.6.1 Describe the meaning of the term liquid crystals.
- C.6.2 Distinguish between thermotropic and lyotropic liquid crystals.
- C.6.3 Describe the liquid-crystal state in terms of the arrangement of the molecules and explain thermotropic behaviour.
- C.6.4 Outline the principles of the liquid-crystal display device.
- C.6.5 Discuss the properties needed for a substance to be used in liquid-crystal displays.

C7 Nanotechnology

- C.7.1 Define the term nanotechnology.
- C.7.2 Distinguish between physical and chemical techniques in manipulating atoms to form molecules.
- C.7.3 Describe the structure and properties of carbon nanotubes.
- C.7.4 Discuss some of the implications of nanotechnology.

C8 Condensation polymers (HL)

- C.8.1 Distinguish between addition and condensation polymers in terms of their structures.
- C.8.2 Describe how condensation polymers are formed from their monomers.
- C.8.3 Describe and explain how the properties of polymers depend on their structural features.
- C.8.4 Describe ways of modifying the properties of polymers.
- C.8.5 Discuss the advantages and disadvantages of polymer use.

C9 Mechanisms in the organic chemicals industry (HL)

- C.9.1 Describe the free-radical mechanism involved in the manufacture of low-density polyethene.
- C.9.2 Outline the use of Ziegler–Natta catalysts in the manufacture of high-density polyethene.

C10 Silicon and photovoltaic cells (HL)

- C.10.1 Describe the doping of silicon to produce p-type and n-type semiconductors.
- C.10.2 Describe how sunlight interacts with semiconductors.

<p>C11 Liquid crystals (HL)</p> <ul style="list-style-type: none"> C.11.1 Identify molecules that are likely to show liquid-crystal properties, and explain their liquid-crystal behaviour on a molecular level. C.11.2 Describe and explain in molecular terms the workings of a twisted nematic liquid crystal. C.11.3 Describe the liquid-crystal properties of Kevlar, and explain its strength and its solubility in concentrated sulfuric acid. <p>C12 The chlor-alkali industry (HL)</p> <ul style="list-style-type: none"> C.12.1 Discuss the production of chlorine and sodium hydroxide by the electrolysis of sodium chloride. C.12.2 Outline some important uses of the products of this process. C.12.3 Discuss the environmental impact of the processes used for the electrolysis of sodium chloride. 	
<ul style="list-style-type: none"> Approach in this course, a brief introduction to various chemical processes and their economy and other aspect (related to environment and human health) are discussed thru a chemical looking glass. 	<ul style="list-style-type: none"> Significant concept(s) / Considerations industry and economy are interrelated. understanding of the chemistry behind most industrial process, which may otherwise pose problems and create serious concern in the field of environment and biodiversity.
<ul style="list-style-type: none"> Guiding Questions Is the industrial growth and economic development more important than human health and biodiversity ? and if so how to balance between the both ends? 	<ul style="list-style-type: none"> Learner Profile <ul style="list-style-type: none"> Thinkers Principled Caring Risk-takers Reflective
<ul style="list-style-type: none"> Central Idea / Content C1 Iron, steel and aluminium 3.5 C2 The oil industry 2 C3 Addition polymers 2 C4 Catalysts 1.5 C5 Fuel cells and rechargeable batteries 2 C6 Liquid crystals 2 C7 Nanotechnology 2 	<ul style="list-style-type: none"> Learning Objectives <ul style="list-style-type: none"> At this age of industrial development and booming economy, its becomes essential for every chemistry student

<ul style="list-style-type: none"> ▪ ▪ Advanced topics ▪ C8 Condensation polymers 1 ▪ C9 Mechanisms in the organic chemicals industry 1 ▪ C10 Silicon and photovoltaic cells 1 ▪ C11 Liquid crystals 2 ▪ C12 The chlor-alkali industry 2 ▪ 	<p>the various chemical processes which are the backbone of the chemical industries. It has its direct relationship in terms of economy, human health and safety and environmental issues. During this course we will be analyzing various important chemical process in the industry, what goes on in terms of chemical transformation and various factors related to human health and economic profitability.</p> <ul style="list-style-type: none"> ▪ 1. State the main sources of iron. Describe and explain the reactions that occur in the blast furnace. Describe and explain the conversion of iron into steel using the basic oxygen converter. Describe alloys as a homogeneous mixture of metals or a mixture of a metal and non-metal. Explain how alloying can modify the properties of metals. Describe the effects of heat treatment of steel. Describe the properties and uses of iron and steel. Describe and explain the production of aluminium by electrolysis of alumina in molten cryolite. Describe the main properties and uses of aluminium and its alloys. Discuss the environmental impact of iron and aluminium production. ▪ 2. Compare the use of oil as an energy source and as a chemical feedstock. Compare catalytic cracking, thermal cracking and steam cracking. ▪ ▪ 3. Addition polymers Describe and explain how the properties of polymers depend on their structural features. Describe the ways of modifying the properties of addition polymers. Discuss the advantages and disadvantages of polymer use. ▪ ▪ 4. Catalysts Compare the modes of action of homogeneous and heterogeneous catalysts. Outline the advantages and disadvantages of homogeneous and
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	<p>heterogeneous catalysts. Discuss the factors in choosing a catalyst for a process.</p> <ul style="list-style-type: none"> ▪ ▪ 5. Fuel cells and rechargeable batteries Describe how a hydrogen–oxygen fuel cell works. Describe the workings of rechargeable batteries. Discuss the similarities and differences between fuel cells and rechargeable batteries. ▪ ▪ 6. Liquid crystals describe the meaning of the term liquid crystals. Distinguish between thermotropic and lyotropic liquid crystals. Describe the liquid-crystal state in terms of the arrangement of the molecules and explain thermotropic behaviour. Outline the principles of the liquid-crystal display device. Discuss the properties needed for a substance to be used in liquid-crystal displays. ▪ ▪ 7. Nanotechnology Define the term nanotechnology. Distinguish between physical and chemical techniques in manipulating atoms to form molecules. Describe the structure and properties of carbon nanotubes. Discuss some of the implications of nanotechnology. ▪ ▪ 8. Condensation polymers (HL) Distinguish between addition and condensation polymers in terms of their structures. Describe how condensation polymers are formed from their monomers. Describe and explain how the properties of polymers depend on their structural features. Describe ways of modifying the properties of polymers. Discuss the advantages and disadvantages of polymer use. ▪ ▪ 9. Mechanisms in the organic chemicals industry (HL)
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	<p>Describe the free-radical mechanism involved in the manufacture of low-density polyethene. Outline the use of Ziegler–Natta catalysts in the manufacture of high-density polyethene.</p> <ul style="list-style-type: none"> ▪ ▪ 10. Silicon and photovoltaic cells (HL) Describe the doping of silicon to produce p-type and n-type semiconductors. Describe how sunlight interacts with semiconductors. ▪ ▪ 11. Liquid crystals (HL) Identify molecules that are likely to show liquid-crystal properties, and explain their liquid-crystal behaviour on a molecular level. ▪ 12. Describe and explain in molecular terms the workings of a twisted nematic liquid crystal. Describe the liquid-crystal properties of Kevlar, and explain its strength and its solubility in concentrated sulfuric acid. The chlor-alkali industry (HL) Discuss the production of chlorine and sodium hydroxide by the electrolysis of sodium chloride. Outline some important uses of the products of this process. Discuss the environmental impact of the processes used for the electrolysis of sodium chloride ▪
<ul style="list-style-type: none"> ▪ Assessment ▪ Other Written Assessment ▪ Acid rain simulation ▪ Other Written Assessment ▪ D, DCP, CE ▪ Other Written Assessment ▪ Worksheet ▪ Other Written Assessment ▪ Determination of dissolved oxygen DCP, CE ▪ Other Written Assessment 	

<ul style="list-style-type: none"> ▪ Assignment ▪ Other Written Assessment ▪ Research assignment ▪ Examination ▪ Test ▪ Other Written Assessment ▪ Soil analysis DCP ▪ Other Written Assessment ▪ Worksheet 		
<ul style="list-style-type: none"> ▪ Information Literacy & ICT ▪ As analytical chemistry is mostly data dependent, simulations available online on mass and NMR generation will be used for showing and predicting structure 	<ul style="list-style-type: none"> ▪ International Mindedness ▪ Is the present international patent law is supportive towards the low cost medicine and better human health? 	<ul style="list-style-type: none"> ▪ TOK ▪ · Who should decide whether particular directions in research are pursued? Who should determine priorities in the funding of research? ▪ · The use of the scanning tunneling microscope has allowed us to “see” individual atoms. Does technology blur the distinction between simulation and reality?
<ul style="list-style-type: none"> ▪ Strategies / Activities / Differentiation ▪ Strategies: ▪ Simulations and videos of industrial processes will be provided to the students to make the process clearer instead of diagram or lecturing. Students will be asked verbal questions and will be asked some chosen specific IB questions to answer while teaching that particular topic. ▪ Activities: ▪ Short quiz and test will be conducted at every class to understand the students understanding of present concepts. Students were asked to discuss in a group to analyse some information and rationalize. 	<ul style="list-style-type: none"> ▪ Resources ▪ · IB chemistry-Geoff Neuss ▪ · Chemistry text book-Catrin Brown ▪ · IB revision guide-Geoff Neuss ▪ · PowerPoint presentations as teaching aid (on core and advanced concepts) ▪ · Web resources (teacher tube etc) ▪ · IB-Question bank on Acid base equilibrium ▪ · Worksheet on industrial techniques ▪ liquid crystals and nanotechnology 	

<ul style="list-style-type: none">▪▪ differentiation:▪ "Weaker students will be helped individually"▪ a simpler version of worksheet and simple version of instruction is given to the students with difficulties.▪▪	<ul style="list-style-type: none">▪ o▪▪
▪ Unit Reflections	
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